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Case Report

Transient Neurologic Deterioration after Total Removal of Parasagittal Meningioma Including Completely Occluding Superior Sagittal Sinus

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In surgical planning of the parasagittal meningioma, invasion and occlusion of the superior sagittal sinus are important factors. When tumor is located within anterior 1/3, or when angiographic finding shows total occlusion of superior sagittal sinus, it is regarded that the ligation of superior sagittal sinus is safe. We report a case of parasagittal meningioma in 59-year-old male patient with complete occlusion of superior sagittal sinus which was confirmed by preoperative angiography, who developed temporary neurologic deterioration after superior sagittal sinus ligation and resection.

KEY WORDS : Parasagittal meningioma · Superior sagittal sinus ligation · Transient neurologic deterioration.

INTRODUCTION

The meningioma which occurs at the parasagittal area is the second-most frequently occurring tumor and consists 17-32% of all areas of development of meningioma. Due to anatomical characteristics associated with main venous drainage of parasagittal meningioma, invasion on superior sagittal sinus (SSS) and relationships with peritumoral venous system was preoperatively considered. As a surgical strategy, it is known that in case of total occlusion into any place of SSS or partial invasion located at anterior 1/3 of SSS, mass excision with SSS ligation or gross total resection can be accessible. Of many reported results, there were few cases of complication when the tumor had occluded the SSS completely. The authors experienced a temporary neurologic deterioration after a SSS ligation and resection in a patient who had total occlusion of SSS. The clinical and radiological details of this case are presented with review of literatures on the cause of temporary neurologic deterioration and treatment options.

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CASE REPORT

A 59-year-old male complained of headache for 2 weeks. On neurological examination, he had showen a mild left hemiparesis. Brain magnetic resonance image (MRI) showed 83 × 46 × 32 mm sized, well-enhanced and well-demarcated mass lesion along the parasagittal area. On angiography, the well stained mass was supplied mainly from the terminal branches of middle meningeal artery and total occlusion of anterior half of SSS was confirmed during the venous phases. We performed a preoperative embolization three days before the surgery (Fig. 1).

Gross total resection including tumor and the lesion which invaded and occluded the SSS was done and the anterior 2/5 of SSS was ligated. The mass was totally removed by Simpson grade I (Fig. 2). Immediate postoperatively, this patient recovered without neurologic deficit. Six hours after the surgery, the patient suddenly changed to stuporous mentality accompanying decreased hemiparesis grade II at left side. At that time, brain CT was performed and confirmed that there was no hematoma or massive brain edema. Twenty-four hours after the surgery, brain MRI was done but no abnormal lesions were found except moderate brain edema that was seen on the preoperative MRI was shown. Therefore, the patient was managed conservatively with impression of subclinical venous infarction due to the

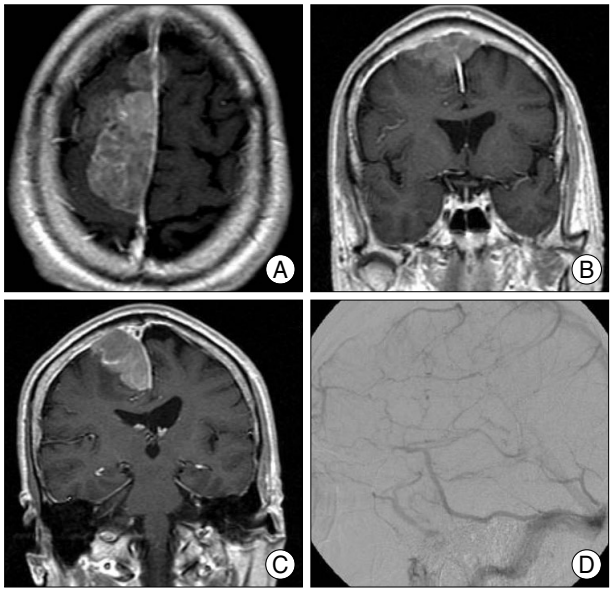

Fig. 1. The preoperative magnetic resonance image (MRI) findings. Preoperative Gd-enhanced MRI axial image (A). Preoperative Gd-enhanced MRI coronal image shows total occlusion of superior sagittal sinus (B). Preoperative Gd-enhanced MRI coronal image shows patent area of superior sagittal sinus (C). Preoperative conventional angiographic finding shows total occlusion of anterior 1/2 of superior sagittal sinus (D).

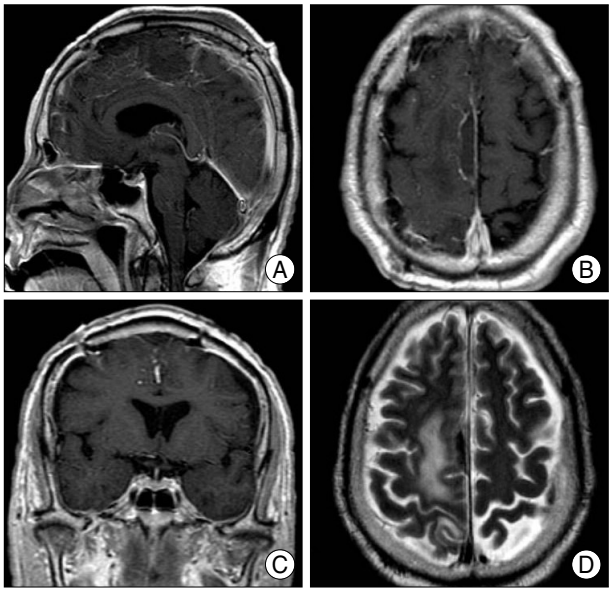

Fig. 2. The postoperative magnetic resonance image (MRI) findings show complete resection of tumor with no venous infarction or abnormal lesions except moderate brain edema that found on preoperative MRI. Post operative Gd-enhanced MRI sagittal image (A). Postoperative MRI axial image (B). Coronal image (C). T2 axial image for surrounding edema (D).

hemodynamic changes. Three days after surgery, the patient's condition was improved to being drowsy with grade III left hemiparesis. He completely recovered the next day, and was discharged 10 days after the surgery.

DISCUSSION

Cushing et al.[3] described that parasagittal meningioma as a tumor which there is no brain tissue between tumor and SSS. Owing to this characteristic, the formation of the perilesional collateral venous channels is influenced by the extent of the tumor growth into the sinus and based on the degree of the venous drainage compromise, venous infarction ensues and neurologic deficit might develop. Additionally, sometimes surgeon meets the situation about tumor bleeding because of their hypervascular characteristics[2]. Due to the above reasons, thorough understanding of the venous system before the surgery and careful venous dissection during the surgery is required. Marks et al.[7] and Naumann et al.[8] reported that subtotal resection of the parasagittal meningioma is deeply related to the high recurrence of the tumor. A surgical procedure such as removal of the occluded sinus together with the tumor en bloc or sinus reconstruction after resection is known to accomplish complete cure. In case of the parasagittal meningioma, the relationship between the tumor and the surrounding structures, especially the sinus, is the measure of successful control of possible recurrence. For this reason, the accessibility of the SSS, extent of its invasion and occlusion are the most important points to be considered. However, despite the carefulness when dealing with the sinus, parasagittal meningioma invading the sinus is not always completely extractable, and reoperation or adjuvant radiosurgery for the remaining tumor is needed in many cases. Therefore, surgeons have been putting lots of efforts to leave minimum amount of tumor and at the same time, to minimize neurologic deficits. From previous experiences, the anterior third of the sinus is safe to be ligated and removed while leaving no neurologic deficits and therefore may be resected when occluded by the tumor up to the safe point[3,4,10].

In our case, anterior half of the sinus was totally occluded on angiography and despite the ligation of only two fifths, transient neurologic deterioration developed and this have not been reported in previous studies. Bonnal et al.[1] categorized the sinus invasion of the parasagittal meningioma into 6 types and Sindou et al.[13] reported the treatment method, necessity of sinus reconstruction and their results which suggest that when sinus reconstruction is performed in invaded cases, postoperative Karnofsky Performance Scale (KPS) score is elevated and that it is even higher when totally occluded[11,12]. The general assumption that complete removal of the invaded sinus is not very dangerous and needs no venous flow restoration may not always be true. Heros et al.[5] explained some facts related to the above that veins, perhaps running within the tumor or on its capsule, provide some degrees of continual flow between the proxi-

mal and distal aspects of the occluded sinus. These veins are usually damaged or occluded on radical excision of the tumor. It is partially or mostly related to surgical trauma to the underlying parenchyma and pial vessels. The transient neurologic deterioration in our case could be explained likewise in which the patient recovered following restoration of the venous drainage after temporary decrease of the venous drainage within the tumor or through tumor capsule. The reasons for inferring likewise are that the brain MRI at the time neurologic deterioration developed did not show postoperative hemorrhage or newly developed postoperative abnormal lesions and that there is no acute infarction on diffusion weighted imaging. Based on these evidences, we suppose that the temporary subclinical venous infarction developed due to the hemodynamic changes from interception of the venous drain which was proved completely occluded via cerebral angiographic venous phase of SSS, yet to have part of the venous drain within the tumor or on its capsule not interfered. Correspondingly, consequent neurologic deficits might be acceptable when the amount of venous drain is minimal in which the deficits usually sustains transient or mild if ever happened. It is true though infrequently, serious neurologic deficits could also result. Therefore, precise angiographic evaluation, especially on the venous phase, is very important. Despite these risks, aggressive tumor removal including the resection of completely occluded of SSS, is inevitable to increase tumor cure rate and to decrease recurrence rate. But some authors suggested that the risks related to aggressive surgery with sinus reconstruction, may be avoided and that for meningiomas that are infiltrating but not obliterating the superior sagittal sinus, conservative surgery may be a reasonable choice. Because opening and resecting the sinus raises concerns of intraoperative and postoperative hemorrhage, sinus occlusion, and cortical vein thrombosis, these concerns are to be considered sufficiently before invasive surgery.

When tumor is not totally resectable, surgeons must have the recurrence and adjuvant radiosurgery in mind. Kondziolka et al.[6] reported a study on radiosurgery of parasagittal meningiomas, that for the large tumors accompanying neurologic deficits after undergoing surgery as a first line treatment, planned second stage rediosurgery should be performed soon afterward for any residual tumor nodule or neoplastic dural remnant. Pamir et al.[9] stated that if postoperative or follow-up MR imaging demonstrates residual tumor or recurrence, radiosurgery is necessary. Stafford et al.[14] mentioned on his report on 190 patients with meningioma that radiosurgery has high tumor control rate up to 89%, no correlation was observed between radiation dose and local control rate, and that only six patients (3%) exhibited decreases in functional status that were directly related to radiosurgery.

CONCLUSION

We experienced a temporary neurologic deterioration after total removal of parasagittal meningioma which completely occluded superior sagittal sinus. We propose that the precise preoperative angiographic evaluation, especially the venous phase, is very important. Having done that, aggressive tumor removal including the completely occluded SSS is necessary to increase tumor cure rate and to decrease recurrence rate. However, when serious neurologic deficits are anticipated, subtotal tumor resection and adjuvant radiosurgery could be considered as an alternative options.

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